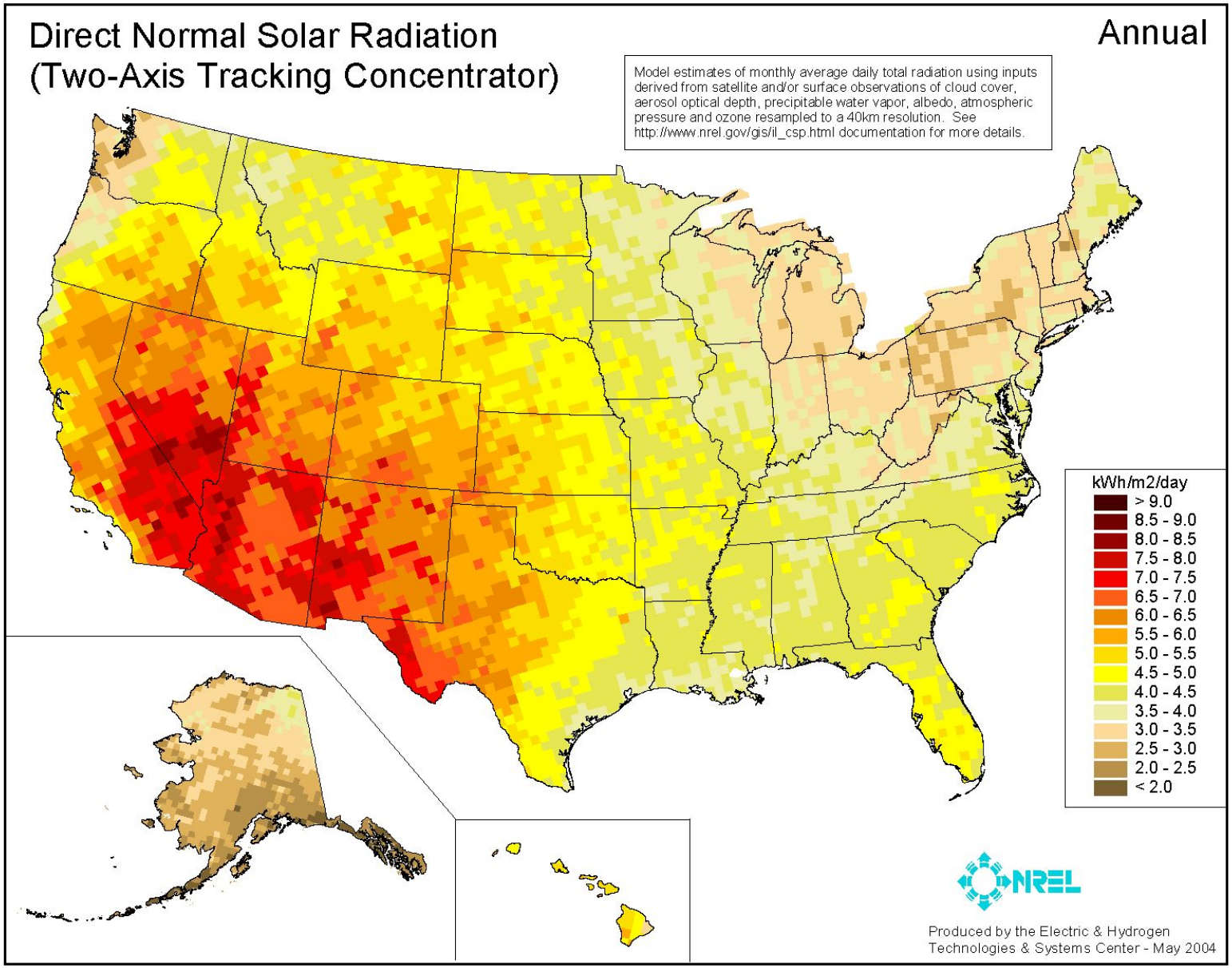
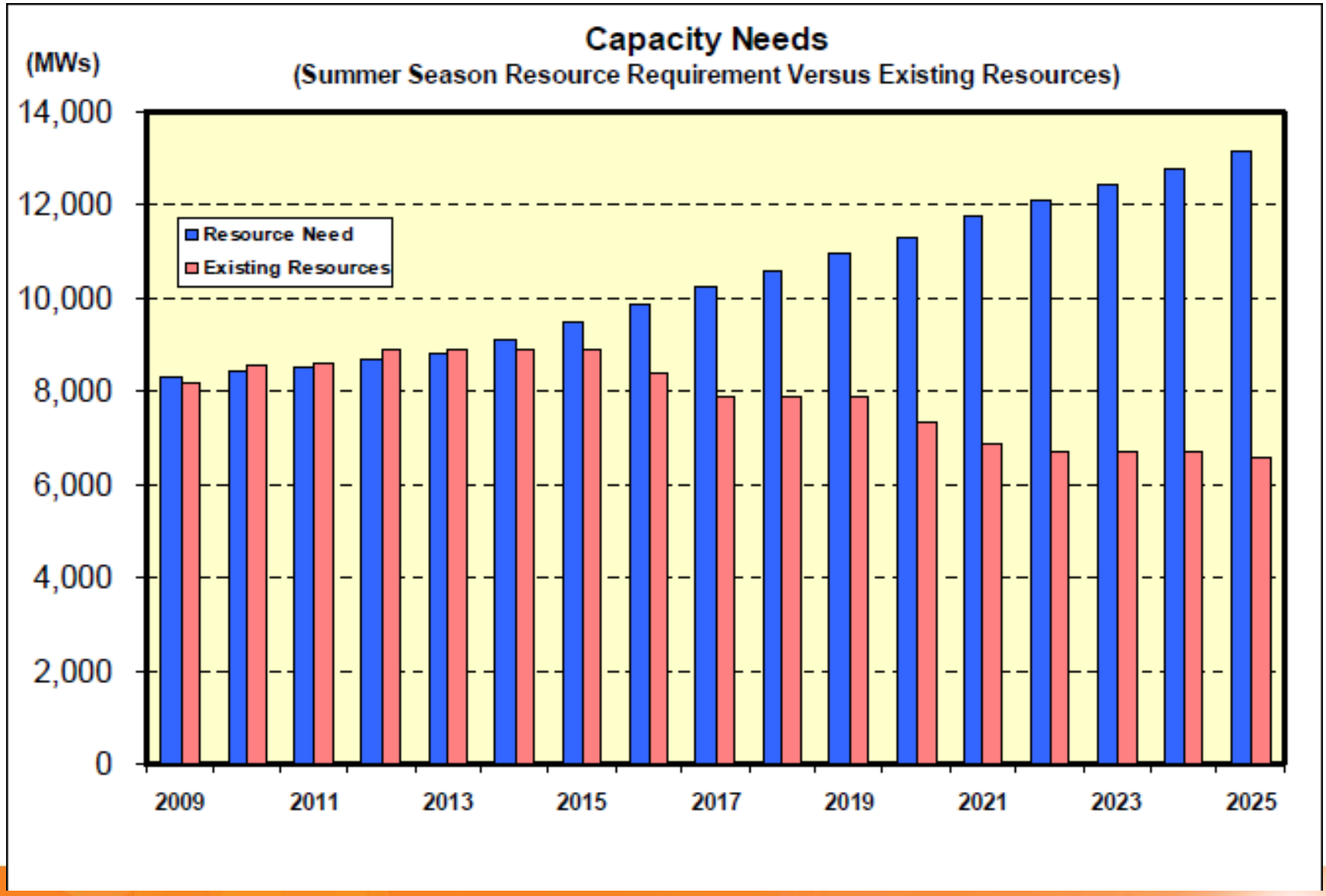
What Do Utilities Want From Photovoltaic??
(At Least This Utility!)

UWIG
Solar User Group Meeting
April 14, 2010
Ron Flood

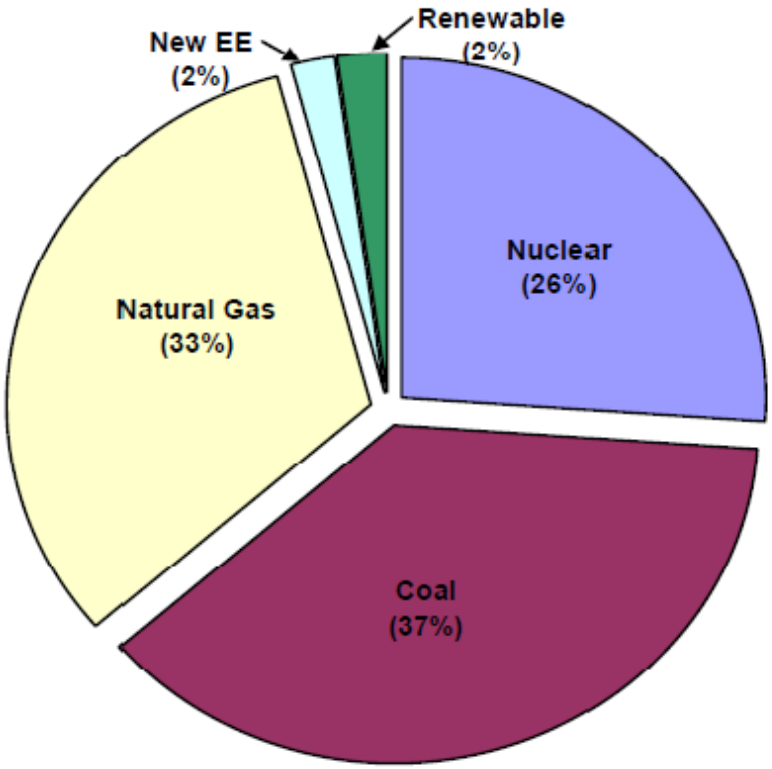
We Want The Energy!


Direct Normal Solar Radiation
(Two-Axis Tracking Concentrator)
Annual
Model estimates of monthly average daily total radiation using inputs derived from satellite and/or surface observations of cloud cover, aerosol optical depth, precipitable water vapor, albedo, atmospheric pressure and ozone resampled to a 40km resolution. See http://www.nrel.gov/gis/il_csp.html documentation for more details.
kWh/m2/day
> 9.0
8.5 - 9.0
8.0 - 8.5
7.5 - 8.0
7.0 - 7.5
6.5 - 7.0
6.0 - 6.5
5.5 - 6.0
5.0 - 5.5
4.5 - 5.0
4.0 - 4.5
3.5 - 4.0
3.0 - 3.5
2.5 - 3.0
2.0 - 2.5
< 2.0
NREL
Produced by the Electric & Hydrogen Technologies & Systems Center - May 2004

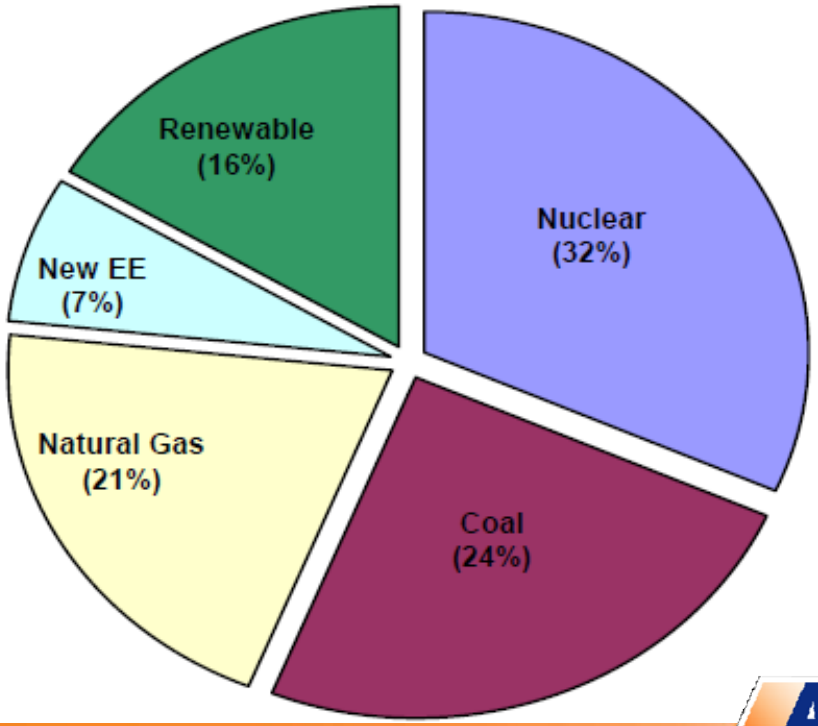


Ref: APS Resource Plan Report, Jan., 2009

2009 Projected Energy Mix



2025 Projected Energy Mix



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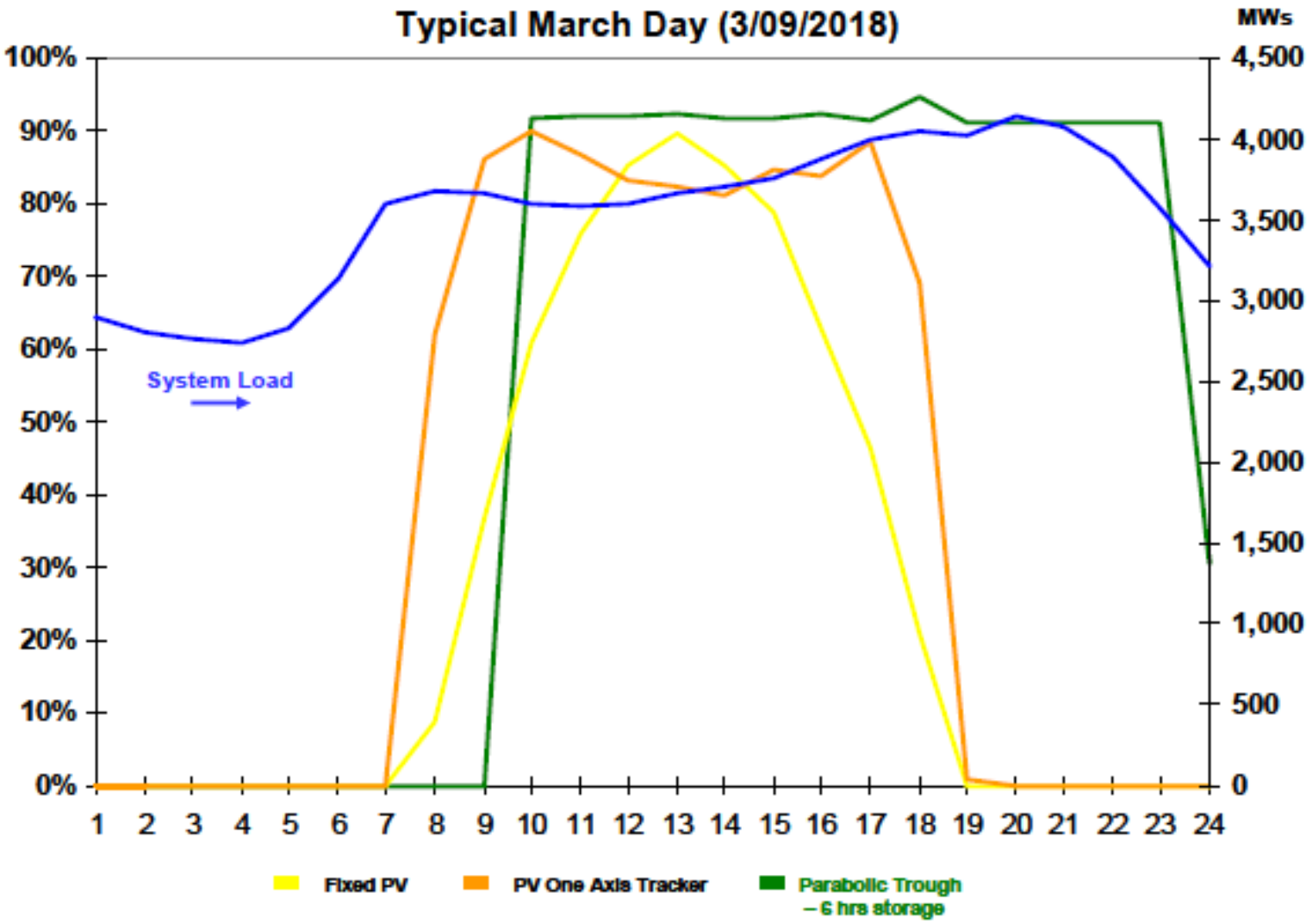

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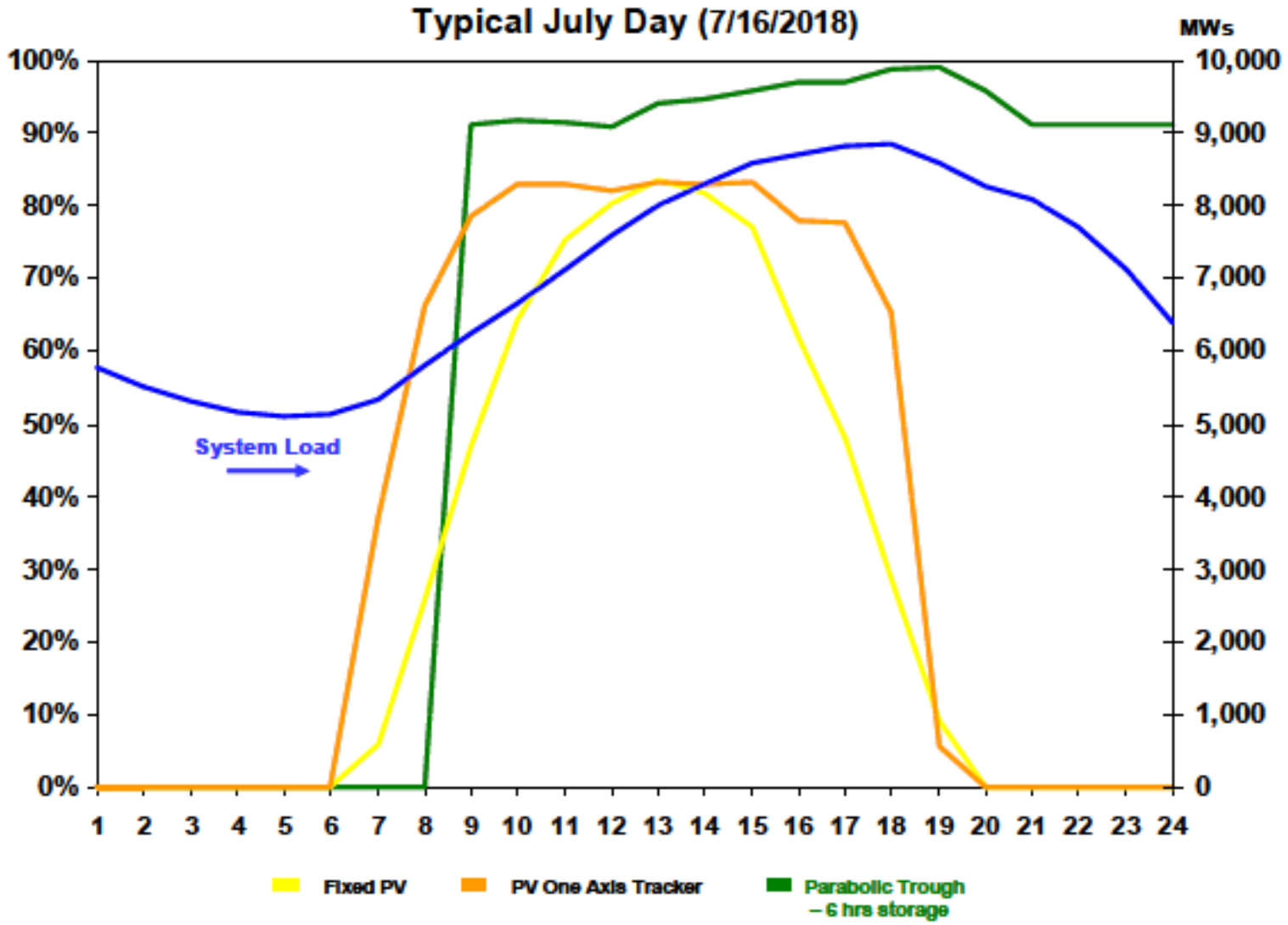

Ref: APS Resource Plan Report, Jan., 2009

So Why?

- Meet Renewable Energy Standard
- Fuel Diversity
- Reduced Emissions
- Arizona Has Good Resource
- Good Production during hours of need
- Distributed Energy can help defer distribution system growth
- PV Technology is advancing significantly with cost efficiencies becoming better with use

WHAT DO WE NEED?

More Study on the Effects of High Penetration Photovoltaic Resource for Distribution Systems

Where Are PVs Building?

- Residential (Both hot water and home use)
- Commercial Buildings and Schools
- Distribution Systems
- Very Limited on Transmission
- Tends to be:
  - Residential; currently spread out, but concentrating much more
  - Commercial; concentrated
  - Distributed Energy; “Utility Size” PV concentrating on distribution system

Transmission vs. Distribution

- Very few requests for interconnect on transmission
  - Location
  - LGIA/SGIA processes vs. Distributed Process
  - Higher Costs of Interconnect Process
  - Transformer and other Power Conversion Costs (Medium vs. High Voltages)
- Lots of activity and focus on Variable Resource interconnection to Transmission
  - WECC
  - NERC/FERC
- Little focus on Variable Resource interconnect to Distribution Systems

Transmission vs. Distribution

- Transmission Interconnects
  - Current PV interconnects; small generating source on transmission systems
  - Transmission generally can provide ancillary services for power quality much easier
- Distribution Interconnects
  - Much higher percentage of the distribution energy,
  - Less capability for ancillary services for power quality with higher penetrations,
  - Higher potential for the effects of variability seen by the CUSTOMER

What Do We Need?

- Models that consider both transmission and distribution interconnects
- Industry and codes/ standards need to catch up with innovation that yields better efficiencies
- Forecasting Tools
  - What is “State of the Art” today?
  - How should forecasting be applied by the utility to get the best utilization of resources?
- Better information
  - Analysis of very short term variability
  - Characterization of effects on distribution systems
- Do there need to be engineering/ technology changes to offset variability to assure the accommodation of large penetration of PV on distribution and eventually transmission!?

How Will We Use The Information?

- Resource Planning
  - Correlation of variable resources with load conditions with weather
  - Better planning of future regulation and reserve generation
  - Costs (both capital and operational) for integration of variable resources
  - Upgrade costs or savings on distribution systems
- Operational
  - Better allocation and management of generating resources
    - Fuel savings
    - Adequacy of generation to meet load and ancillary requirements
  - Maintaining good power quality for distribution customers
  - Better analysis of interconnecting entities for increasingly larger Photovoltaic Generators.
- Help Internal and External APS Stakeholders “feel more comfortable” with the variable resources.

Prescott Project

- 3 Mw of PV on 5 Mw feeder
- Set up meteorological stations around the site
- Include imaging
- Improve metering capability on PV site and distribution system
- Gather time stamped one second data for about 3 months
- Analyze and publish data results
- Share data on the User Group Sharepoint site

Prescott Project Participants

- Arizona Public Service
  - Renewable Technical Services
  - STAR (Solar Test and Research Facility)
  - Energy Delivery
  - Resource Planning
- Northern Arizona University
- 3Tier Forecasting
- Advisement from others